Abstract

This thesis describes the conductivity fluctuations or noise measurements in graphene-based field effect transistors. The main motivation was to study the effect of disorder on the electronic transport in graphene.

In chapter 4, we report the noise measurements in graphene field effect (GraFET) transistors with varying layer numbers. We found that the density dependence of noise behaves oppositely for single and multilayer graphene. An analytical model has been proposed to understand the microscopic mechanism of noise in GraFETs, which reveals that noise is intimately connected to the band structure of graphene. Our results outline a simple portable method to separate the single layer devices from multi layered ones. Chapter 5 discusses the noise measurements in two systems with a bandgap: biased bilayer graphene and graphene nanoribbon. We show that noise is sensitive to the presence of a bandgap and becomes minimum when the bandgap is zero.

At low temperature, mesoscopic graphene devices exhibit universal conductance fluctuations (UCF) arising due to quantum interference effect. In chapter 6, we have studied UCF in single layer graphene and show that it can be sensitive to the presence of various physical symmetries. We report that time reversal symmetry exists in graphene at low temperature and, for the first time, we observed enhanced UCF at lower carrier density where the scattering is dominated by the long-range Coulomb scattering. Chapter 7 presents the transport and noise measurements in single layer graphene in the quantum Hall regime. At ultra-low temperature several broken symmetry states appear in the lowest Landau level, which originate possibly due to strong electron-electron interactions. Our preliminary noise measurements in the quantum Hall regime reveal that the noise is sensitive to the bulk to edge transport and can be a powerful tool to investigate these new quantum states.